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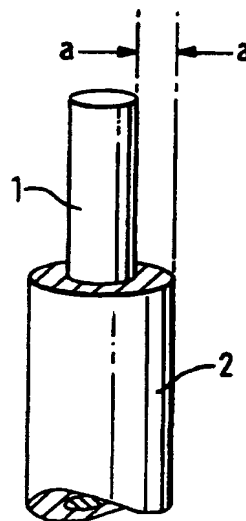
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(56) Documents Cited  
**GB 2137080 A** **GB 0880228 A**  
**WPI Abstract Accession No. 93-240308 &**  
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(54) Abstract Title  
**Colour-changing, wear-indicating toothbrush filaments**

(57) Colour-changing, wear-indicating, toothbrush filaments comprise a core 1 of resilient plastics material of one colour and an outer surface 2 at least partly coated with a biodegradable material of a different colour.



**FIG. 2**

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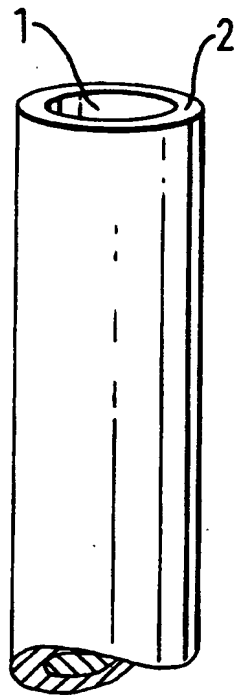


FIG. 1

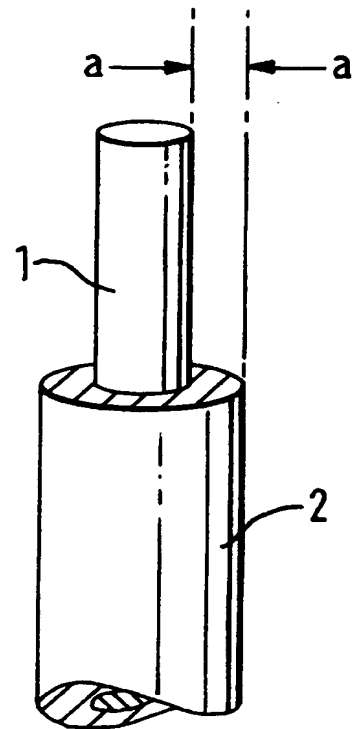


FIG. 2

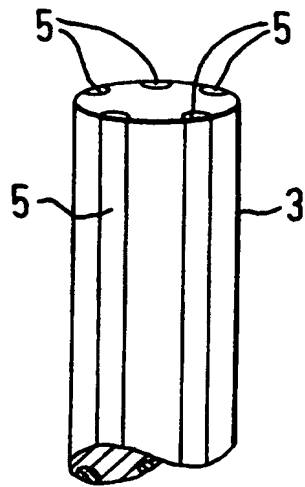


FIG. 3

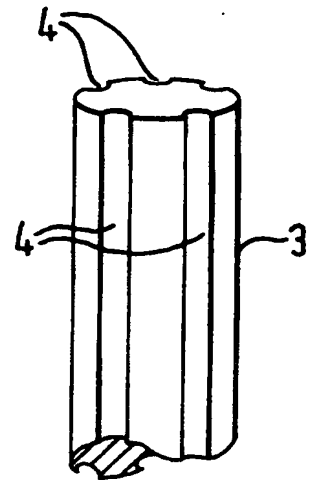


FIG. 4

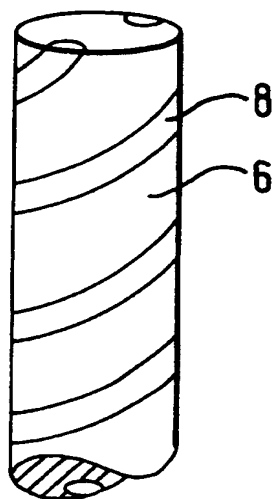


FIG. 5

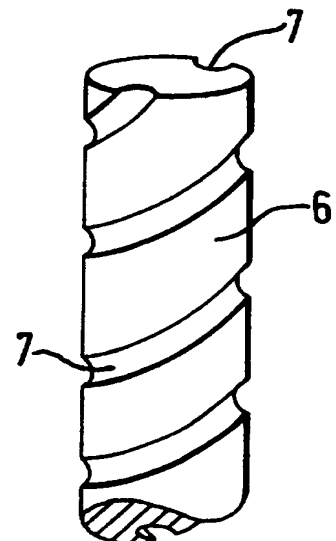


FIG. 6

**COLOUR-CHANGING WEAR-INDICATING****FILAMENTS**

This invention relates to colour-changing wear-indicating filaments for toothbrushes.

5 Various types of toothbrushes with colour-changing filaments are known. The principle used in such toothbrushes is to immerse the bristles into an aqueous solution containing a dye to colour the outer cross-section of the bristles so that they exhibit a different colour to the core of the bristle filament. On use of the brush the dye leaches into water, gradually releasing the dye over a period so that there is a change in the colour  
10 of the bristles to indicate the life and wear of the toothbrush.

These known toothbrushes with water dispersible dye tend to release the dye on constant contact with water and are not a true indication of the wear of the bristles.

An aim of the present invention is to provide an improved colour-changing indicator for bristles.

15 According to the present invention there is provided a colour-changing wear-indicating filament for toothbrushes comprising a core of resilient plastics material of one colour and an outer surface at least partly coated with a biodegradable material of a different colour.

Preferably, the biodegradable material is DUPONT "Biomax" (Trade Mark).  
20 Alternatively the biodegradable material may be MONSANTO "Biopol" (Trade Mark).

Conveniently, the core of the plastics material is a DUPONT nylon derivative 6.12 (Trade Mark). In an alternative embodiment the core of plastics material may be a polyester based polymer polybutylene terephthalate (PBT).

The core of plastics material may be encircled by an outer layer of biodegradable  
25 material. Alternatively the core may have a plurality of flutes extending parallel to the core axis, the outer biodegradable material comprising strips located in the flutes.

In a preferred construction the core may be formed with a continuous helical groove extending around its outer surface, the helical groove having a strip of biodegradable material inserted therein.

30 Embodiments of the invention will now be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a fragmentary perspective view of a filament according to the invention;

Figure 2 is a similar view to Figure 1 with the inner core of the filament exposed;

Figure 3 is a fragmentary perspective view of a second embodiment of a filament  
5 according to the invention;

Figure 4 is a similar view to Figure 3 of the core of the filament before the strips of coating are inserted;

Figure 5 is a third embodiment of the invention showing a fragmentary perspective view of a filament with a helical inset of coloured material; and

10 Figure 6 is similar view to Figure 5 of the core of a filament, with a helical groove, before the coloured material is inserted.

The toothbrush filament, a fragment of which is illustrated in Figures 1 and 2, has an inner core 1 of a coloured nylon derivative such as 6.12 manufactured by DUPONT (Trade Mark). Alternatively it could be a polyester based polymer PBT.

15 Encircling the rod-shaped core 1 is an outer layer 2 of a biodegradable polymer such as DUPONT "Biomax" or MONSANTO "Biopol". The filaments are co-extruded and cut into tufts for incorporation into a toothbrush (not shown). The outer layer 2 is of a different colour to the filament core 1 and when the toothbrush filaments are used in conjunction with a cleaning agent, such as a toothpaste or a toothgel, the outer layer 2  
20 undergoes a physical change whereby the outer covering disintegrates over a controlled period of time exposing the inner core 1 of a different colour.

An illustration of the disintegration of the covering layer 2 is shown by the line a-a in Figure 2, where the tip of the filament is removed exposing the inner core 1 after a predetermined length of time equivalent to three months.

25 The biodegradable process is initiated when the toothbrush user starts brushing his teeth and introduces water, food debris, toothpaste or toothgel into the filaments.

The biodegradable layer 2 is removed i.e. disintegrated from the filament core 1 under aerobic conditions when the polymer chain of the outer layer 2 is broken down into CO<sub>2</sub> and water and under anaerobic conditions into CO<sub>2</sub> and methane. The amount of  
30 wear on the filament is therefore affected by the amount of use of the toothbrush, causing mechanical removal of the coating in addition to the biodegradable disintegration. The

change in colour of the filament is noticeable depending on the advancement of the biodegradability, i.e. the level of micro-organisms present in the filament.

5 A second embodiment of the invention is illustrated in Figures 3 and 4 where the inner core 3 of nylon or PBT material is extruded with flutes 4 running parallel to the longitudinal axis of the core. Inserted in the parallel flutes 4 are strips 5 of biodegradable material as described above. The core 3 is of a different colour to the strips 5 so that on gradual disintegration of the strips 5, the colour of the filament changes. The filament is extruded in one process.

10 A third embodiment of the filament according to the invention, is illustrated in Figures 5 and 6, where the core 6 of nylon or PBT is extruded with a helical groove 7 encircling the core. The groove 7 is filled with a continuous strip 8 of biodegradable material. The strip 8 is of a different colour to the core 6.

15 As in the previous embodiments, on using a toothbrush containing the two extruded filaments, the biodegradable material gradually disintegrates, so that over a period, e.g. three months, the core 6 is exposed, changing the colour of the filament and indicating wear of the toothbrush and when it requires replacement.

**CLAIMS:**

1. A colour-changing wear-indicating filament for toothbrushes comprising a core of resilient plastics material of one colour and an outer surface at least partly coated with a biodegradable material of a different colour.
- 5 2. A colour-changing wear-indicating filament as claimed in Claim 1, wherein the biodegradable material is DUPONT "Biomax" (Trade Mark).
3. A colour-changing wear-indicating filament as claimed in Claim 1, wherein the biodegradable material is MONSANTO "Biopol" (Trade mark).
4. A colour-changing wear-indicating filament as claimed in any preceding claim,  
10 wherein the core of the plastics material is a DUPONT nylon derivative 6.12 (Trade Mark).
5. A colour-changing wear-indicating filament as claimed in any of Claims 1 to 3, wherein the core of plastics material is a polyester based polymer PBT.
6. A colour-changing wear-indicating filament as claimed in any preceding claim,  
15 wherein the core of plastics material is encircled by an outer layer of biodegradable material.
7. A colour-changing wear-indicating filament as claimed in any of Claims 1 to 5, wherein the core has a plurality of flutes extending parallel to the core axis, the outer biodegradable material comprising strips located in the flutes.
- 20 8. A colour-changing wear-indicating filament as claimed in any of Claims 1 to 5, wherein the core has a continuous helical groove extending around its outer surface, the helical groove having a strip of biodegradable material inserted therein.
9. A toothbrush having a plurality of tufted bristles moulded in its head, wherein the bristles are made of a filament as claimed in any preceding claim.
- 25 10. A colour-changing wear-indicating filament substantially as herein described with reference to and as shown in Figures 1 and 2, Figures 3 and 4 or Figures 5 and 6 of the accompanying drawings.



# The Patent Office

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**Application No:** GB 9705066.0  
**Claims searched:** 1-10

**Examiner:** Graham Werrett  
**Date of search:** 4 June 1997

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): A4K, D1W.

Int Cl (Ed.6): A46D, D02G.

Other: Online: WPI.

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	GB 2137080 A (CORONET)	1
X, Y.	GB 0880228 (BEST)	1
Y	WPI Abstract Accession No. 93-240308 & JP 050163616 (SHOWA) 29. 06. 93 (see abstract)	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.